Does early defibrillation improve long-term survival and quality of life after cardiac arrest?

Bunch TJ, White RD, Gersh BJ, Meverden RA, Hodge DO, Ballman KV, et al. Long-term outcomes of out-of-hospital cardiac arrest after successful early defibrillation. *N Engl J Med* 2003;348:2626-33.

Background: Out-of-hospital cardiac arrest secondary to ventricular fibrillation (VF) carries a grim prognosis. Early defibrillation is important for successful resuscitation and survival. Automatic external defibrillators (AEDs) are simplified defibrillators that can be used by non-health care professionals. The operator places 2 electrode pads on the chest of a collapsed person. The AED then determines whether or not the person has a ventricular arrhythmia requiring defibrillation. The machine gives the operator instructions (often with voice commands) to either shock the patient by pressing a button, or to initiate cardiopulmonary resuscitation.

Question: What is the impact of early defibrillation on long-term survival and quality of life?

Design: This single-centre prospective cohort study, conducted in Olmstead County, Minn., involved all patients who had an out-of-hospital cardiac arrest from November 1990 to December 2000 after implementation of a local early defibrillation program. As part of the program, the use of AEDs had been broadened to include police officers, firefighters and paramedics. All patients were followed to determine long-term survival and quality of life.

Results: Of the 200 patients with an out-of-hospital cardiac arrest with ventricular fibrillation, 145 (72%) survived to hospital admission with spontaneous circulation, 84 (42%) survived to hospital discharge, and 79 (40%) were neurologically intact at discharge. Long-term survival was realized by 60 patients (30%). For analysis, patients with significant neurological impairment at discharge were considered nonsurvivors. The key baseline differences between the survivors and nonsurvivors are shown in Table 1. The mean length of follow-up was 4.8 (standard deviation 3.0) years. The expected 5-year survival rate (79%) was identical to that among age-, sex- and disease-matched control subjects from the general population. The quality of life among the majority of survivors was similar to that of the general population.

Commentary: Early defibrillation is the key determinant of survival from cardiac arrest. The study by Bunch and associates, although small in numbers and from a single centre, demonstrates impressive results after implementation of an early defibrillation program. Similarly, a trial of AED use in casinos by security personnel demonstrated a rate of survival to hospital discharge of 59% among people with a witnessed cardiac arrest due to VF.[1] In that study, the mean time to defibrillation was 4.4 minutes.

In contrast, patients with VF in the Ontario Prehospital Advanced Life Support study had a rate of survival to hospital discharge of only 10%.[2] This much larger study included 3447 patients with out-of-hospital ventricular arrhythmia. The authors concluded that shorter times to defibrillation are crucial to reducing the rate of death from VF.

Most studies of cardiac arrest have used return of spontaneous circulation and survival to hospital discharge as primary end points. The study by Bunch and associates shows that long-term survival is also possible and that those who survive report a good quality of life.

Implications: Broadening access to and training in AED use beyond health care professionals can help reduce the time to defibrillation and therefore increase survival from cardiac arrest. Deciding who to trained in AED use (e.g., police officers, security guards, general public), where to place AEDs (e.g., shopping malls, arenas, airports) and how to fund early defibrillation programs will help to determine the success of these programs.

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Table 1: Key baseline demographic characteristics of patients who had an out-of-hospital cardiac arrest with ventricular fibrillation and who were admitted to hospital

Characteristic	Survived to discharge n = 79	Died before discharge* n = 63	p value
Age, mean (SD), yr	61.9 (15.9)	68.1 (14.3)	0.02
Hypertension, % of patients	14	36	0.005
Time from 911 call to administration of first shock from defibrillator, mean (SD), min	5.7 (1.6)	6.6 (1.5)	0.002
Witnessed arrest, % of patients	92	75	0.008

Note: SD = standard deviation.
*Includes patients who had severe neurological impairment at time of discharge.

References
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2. De Maio VJ, Stiell IG, Wells GA, Spaite DW; Ontario Prehospital Advanced Life Support Study Group. Optimal defibrillation response intervals for maximum out-of-hospital cardiac arrest survival rates. *Ann Emerg Med* 2003;42:242-50.